



Sheet 3

The line and bus data of power system shown in Fig (1) are given in per unit in Tables (1) and (2).

Find: (a) the bus voltages; (b) the power flow through lines; (c) the active and reactive power generations at slack bus and reactive power generations at voltage control bus.

Initial bus	Final bus	R	x_L	$\frac{y_C}{2}$
1	2	0.01008	0.0504	0.05125
1	3	0.00744	0.0372	0.03875
2	4	0.00744	0.0372	0.03875
3	4	0.01272	0.0636	0.06375

Table (1)

Bus No.	Bus voltage	P_G	Q_G	P_D	Q_D
1	$1\angle 0^\circ$	-	-	0.5	0.3099
2	$1\angle 0^\circ$	0	0	1.7	1.0535
3	$1\angle 0^\circ$	0	0	2.0	1.2394
4	$1.02\angle 0^\circ$	3.18	-	0.8	0.4958

Table (2)

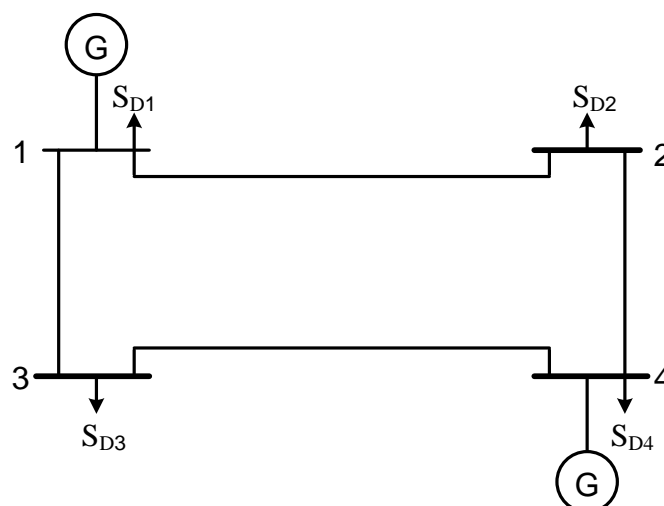


Figure (1)



ANS :

From data the bus types are taken as:

Bus No.	Bus type
1	Slack
2	Load
3	Load
4	Voltage control

$$Y_{bus} = \begin{bmatrix} 8.985 - j44.836 & -3.816 + j19.078 & -5.170 + j25.848 & 0 \\ -3.816 + j19.078 & 8.985 - j44.836 & 0 & -5.170 + j25.848 \\ -5.170 + j25.848 & 0 & 8.193 - j40.864 & -3.024 + j15.119 \\ 0 & -5.170 + j25.848 & -3.024 + j15.119 & 8.193 - j40.864 \end{bmatrix}$$

For Itr = 9 or Tol = 0.0001:

Itr	V ₁	δ ₁	V ₂	δ ₂	V ₃	δ ₃	V ₄	δ ₄
9	1.0000	0.0000	0.9824	-0.9811	0.9690	-1.8754	1.0200	1.5184

Line	Power Flow	Power Losses
S12	0.3886 + 0.2740i	0.0023 + 0.0114i
S21	-0.3863 - 0.2626i	0.0023 + 0.0114i
S13	0.9826 + 0.6507i	0.0103 + 0.0517i
S31	-0.9723 - 0.5990i	0.0103 + 0.0517i
S24	-1.3155 - 0.7037i	0.0172 + 0.0858i
S42	1.3327 + 0.7895i	0.0172 + 0.0858i
S34	-1.0288 - 0.5440i	0.0183 + 0.0917i
S43	1.0471 + 0.6357i	0.0183 + 0.0917i

Bus	Pg	Qg
1	1.8711	1.1445
2	----	----
3	----	----
4	----	1.8144